making better contact, and allowing a stronger current to flow. At every condensation of the air the membrane moved backward, and the upper end of the lever moved forward, so as to press less strongly than before against the spring, thereby making a less complete contact than before, and by thus partially interrupting the passage of the current, caused the current to flow less freely. The sound-waves which entered the air would in this fashion throw the electric current, which flowed through the point of variable contact, into undulations in strength. Reis himself termed the contact-part of his telephone an interruptor. That it was not intended to operate as an abrupt make-and-break arrangement, as some persons have erroneously fancied, is evident; firstly, because the inventor introduced delicate springs to give a following-contact, and so prevent abrupt breaks from occurring; secondly, because abrupt breaks would have violated the fundamental principle to which he refers in the sentence immediately preceding his description of the instrument shown to the Frankfort Society, namely that of creating tones whose curves were like the undulatory curves imparted at the transmitting end of the instrument; thirdly, because (in another article) he described his instrument as opening and closing the circuit in proportion to the sound-wave, which obviously an abrupt "break-and-make" apparatus without a spring-contact could not possibly do. The mechanism which Reis thus invented —and which is substantially alike in all his instruments —might be appropriately described as the combination of a tympanum with an electric current-regulator, the essential principle of the electric current-regulator being the employment of a loose or imperfect contact between the two parts of the conducting system, those parts being so arranged that the vibrations of the tympanum would alter the degree of contact, and thereby vary the resistance offered at the point of contact to the passage of the current, and so regulate the strength of the current that it should magnetise and demagnetise the core of a distant electromagnet in a manner corresponding to the undulations of the tympanum of the transmitter.

The particular form of the instrument shown at Frankfort in 1861, and described in the *Journal*, is somewhat different from the "ear." The figure (5) and description are taken from the *Journal*.

"In a cube of wood, *r s t u v w x*, there is a conical hole, *a*, closed at one side by the membrane, *b* (made of the lesser intestine of the pig), upon the middle of which a little strip of platinum is cemented as a conductor of the current. This is united with the binding-screw, *p*. From the binding-screw, *n*, there passes likewise a thin strip of metal over the middle of the membrane, and terminates here in a little platinum wire, which stands at right angles to the length and breadth of the strip. From the binding-screw, *p*, a conducting-wire leads through the battery to a distant station."

In the original instrument there is also an adjusting-screw to regulate the contact, though this is not shown in the drawing.

The receiver used to reproduce the sounds transmitted by these telephones is also described in the memoir of Reis. It consisted of a steel needle surrounded by a coil of wire. This was at first set up for the purpose of increasing the sounds by resonance, upon the top of a violin; later it was mounted upon a pinewood box, to which still later a lid of thin pine was added against which the listener could press his ear. The sounds emitted by such a wire during magnetisation and demagnetisation were well known before, but to Reis is due the discovery that other tones than the natural vibration-tone of the wire could be electrically imposed upon it by the varying magnetising force of the current in the surrounding coil. Reis explained the reproduction of the transmitted sounds by supposing a magnetic attraction between the atoms of the steel wire to work synchronously with the fluctuations of the current. He later devised a different receiver in which an electromagnet was provided with an elastically mounted armature of iron which it threw into vibrations corresponding to those of the original sound waves. With this apparatus and a transmitter with a small curved lever like that in the "ear," he was able (see Kuhn's "Handbuch der Angewandten Elektricitätslehre," 1866, p. 1021) not only to reproduce melodies with astonishing exactness, and single words as in speaking and reading (less distinctly), but even to transmit the inflexions of the voice expressive of surprise, command, interrogation, &c.

Considering how far these early researches were carried, it is remarkable that their historic value has been so greatly overlooked. SILVANUS P. THOMPSON

SQUALLS

IN a short calendar for the present year, issued by Dr. Gustavus Hinrichs,[1] are two interesting charts of the fronts of squalls passing over Iowa from north-west to south-east. He remarks that the lines between which ·5 inch and 1·0 inch of rain fell in one of these squalls on July 31, 1877, gradually diverge as the storm-front rolls down to the south-east, while bending more and more, so as strangely to recall the lines of equal timber in Eastern and Southern Iowa.

The lines showing the configuration of these squalls are very similar to those showing the shapes of the most extensive European squalls, and the almost complete parallelism between the chart of the squall above alluded to, and those[2] of the *Eurydice* squall, which traversed England on March 24, 1878, is worthy of the attention of meteorologists. Squalls of this description strictly deserve the name of "arched squalls" (apparently bestowed by English seamen on all squalls which are seen in perspective to rise as arches of cloud above the horizon), for when plotted out upon a chart they are found to be, at the period of their greatest development, *scimitar or crescent-shaped*, the central portion of the area of squall being in front of the right and left wings, and a chord of the arc so formed being commonly normal, or nearly so, to the isobars existing at the time. It seems probable that the most projecting portion of the line of clouds forming the front of the squall traverses the line of steepest atmospheric gradients, but of this no proof has yet been furnished. The strongest wind is, in any case, commonly experienced in the immediate front of the squall along the line traversed by the focus of the squall, and the greatest precipitation in the rear is also usually experienced along this line. There is one characteristic which the crescent-shaped squall shares with the very local squalls common in the temperate latitudes in the rear of a depression, viz. the violent down-rush of cold air experienced under the front of the squall-cloud, followed by a comparative calm in its wake. In the crescent-shaped squall there is a veering of the lower wind and a backing of the upper wind, sometimes to the extent of about eight points, which is not traceable in the more local squall. In the crescent-shaped squall a sudden increase of atmospheric pressure is experienced at the earth's surface at the time of the strongest rush of wind. This characteristic seems to be shared by the majority of squalls which occur in the Persian Gulf and in Northern India from the north-west, and also by many squalls in the Indian and China seas (which may possibly prove to be of the crescent-shaped type); and it is precisely analogous to the rise of barometer frequently noticed at inland localities in the temperate zones during a summer thunderstorm. It is, however, stated that in

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[1] "Notes on the Cloud Forms and Climate of Iowa." Dr. G. Hinrichs, Director Iowa Weather Service.

[2] *Meteorological Magazine*, vol. xiii. p. 33; *Nautical Magazine*, vol. xlvii. 5.

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the "tornadoes" of the Gold Coast (which are merely severe squalls) a fall of the barometer occurs. In some squalls, especially in the Indian and China seas, a change of wind occurs to nearly an opposite point of the compass, and in these instances there is sometimes a diminution of pressure [1] during the passage of the squall. These squalls I should regard as small typhoons.

The clouds which mark the front of an actual typhoon, as described by Dampier [2] and subsequent navigators, seem to be very similar to those which accompany the true squall, wherever observed. These consist of a dense curtain of ice-cloud in the higher regions of the atmosphere, usually permeated, except in the extreme rear, by mountainous cumuli from beneath, and having, when viewed at a distance, a very white and shining appearance. In the final stage of the squall, when it is diminishing in severity, these cumuli commonly disappear. A watchful outlook for these clouds, not least of all when coming off a high windward shore, may save many sailing vessels, as it might in all probability have saved the *Eurydice*, from destruction. W. CLEMENT LEY

NOTES

As we anticipated some weeks ago (p. 41), Prof. Lord Rayleigh has been nominated by the Council of the British Association as President for the Meeting at Montreal in 1884. The death of the late Prof. H. J. S. Smith having caused a vacancy among the vice-presidents elected at Southampton for the meeting at Southport in the present year, the Council have nominated Dr. J. M. Dawson, C.M.G., F.R.S., Principal of McGill College, Montreal, to be a vice-president.

PROF. HUXLEY'S Rede Lecture will have for its subject "The Origin of the Existing Forms of Animal Life: Construction or Evolution?" It will be delivered in the Senate House (Cambridge) on Tuesday next at noon.

THE death is announced of M. Charles Bresse, on May 22, at the age of sixty-one years. He was, since 1855, Professor of Mechanics in the School of the Ponts et Chaussées, and also for the last few years at the École Polytechnique.

A SERIES of conferences will be held in connection with the Fisheries Exhibition, in which the foreign commissioners, jurors, and others connected with or visiting the Exhibition, will be invited to take part. The first meeting of the Congress will be held on Monday, June 18, at 12 noon, when Prof. Huxley will deliver an introductory address. H.R.H. the Prince of Wales, K.G., has graciously consented to read a paper by H.R.H. the Duke of Edinburgh, K.G., entitled "Notes on the Sea Fisheries and Fishing Population of the United Kingdom," on Tuesday, June 19, at 12 o'clock. At all other conferences, the chair will be taken by the appointed chairman at 11 o'clock a.m. precisely. Papers will be read, and discussions on them will follow. The conferences will be held on Mondays, Tuesdays, Thursdays, and Fridays.

THE Company of Grocers have announced as the matter of competition for the first quadrennial discovery prize of 1000*l.* the following problem:—"To discover a method by which the vaccine contagium may be cultivated apart from the animal body, in some medium or media not otherwise zymotic: the method to be such that the contagium may by means of it be multiplied to an indefinite extent in successive generations, and that the product after any number of such generations shall (so far as can within the time be tested) prove itself of identical potency with standard vaccine lymph." The prize is open to universal competition, British and foreign. Competitors for the prize must submit their respective treatises on or before December 31, 1886, and the award will be made not later than May, 1887. In relation to this prize, as in relation to other parts of the Company's scheme in aid of sanitary science, the Court acts with the advice of a scientific committee which at present consists of the following members:—Messrs. John Simon, F.R.S., John Tyndall, F.R.S., John Burdon Sanderson, M.D., F.R.S., and George Buchanan, M.D., F.R.S.

A CORRESPONDENT in West Australia writes to us that the Exploring Expedition to Kimberly District, North-West Australia, to which Mr. E. T. Hardman, of the Geological Survey of Ireland, is attached as geologist, reached Roebuck Bay, Kimberly (lat. 18° ·10′ S., long. 122° E.) on April 9, after a favourable voyage from Fremantle of ten days; all well, with the exception of a native who, in a fit of delirium, jumped overboard and was lost. Mr. Hardman proceeds with Mr. John Forrest, Surveyor-General, a well-known and experienced explorer, on a preliminary examination of the district for some months, and will then accompany the main party about to make a trigonometrical survey of the country along the Fitzroy River traced in 1879 by Mr. Alexander Forrest. The party, which consists of thirty-two, all told, with fifty horses, left Fremantle in the *Macedon*, on March 25, but were shipwrecked on Rottnest Island, and subsequently went on in the steamer *Rob Roy*. The field-work will be continued until the middle of next November, and will probably be resumed next year. Previous explorers pronounce this district to be one of the best in West Australia.

WE have received a communication from Herr Sophus Tromholt, dated Bossekop, May 18, in which he informs us that his work at Kautokeino having been finished he has paid a visit both to the Finnish station at Sodankylä and the Norwegian at Bossekop. Herr Tromholt now intends to proceed to Bergen, and promises, when settled, to send an account to NATURE of his final researches on the aurora borealis. He states, however, that at neither of the above-mentioned stations has any photograph of the aurora been obtained. Next winter, Herr Tromholt informs us, he will spend in Iceland, in order to proceed with his studies of the aurora borealis there, chiefly on the principle laid down by Prof. Lemström, and with the apparatus invented by the latter.

SIR JOHN LUBBOCK has given notice that he intends on Friday three weeks to draw attention to the fact that the Minister whose duty it is to bring forward the Educational Estimates has no power to appoint officers, and to move that it is desirable that there should be a separate department of education.

IT is stated that M. Jules Verne, the world-known novelist, will offer himself as a candidate to fill the chair vacated in the Académie Francaise by the recent death of M. Jules Sandeau.

AN Exhibition of Hygienic Dress and Sanitary Appliances, intended to illustrate as far as possible the aims and objects of the National Health Society, was opened by the Lord Mayor on Saturday afternoon, in Humphreys Hall, Knightsbridge. The Exhibition, which will continue for a fortnight, includes clothing, food products, everything connected with the sanitation of the house and hygienic decoration, appliances for the sick-room, home nursing, and home education, industrial dwelling and cottage hygiene, heating, lighting, and cooking apparatus, fuel, &c. Perhaps, however, the greatest attention will be devoted to the stands of the Rational Dress Society, and another close to it, where are shown examples of ladies' dresses made on purely hygienic principles.

TOURISTS with entomological proclivities who may be about to visit the Alps, Pyrenees, Norway, or other parts of Europe, will find Dr. H. C Lang's "Butterflies of Europe" (L. Reeve

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[1] Schück. *Annalen der Hydrographie*, March, 1877; *Quart. Journ. Met. Soc.* vol. iv p. 78.

[2] "Voyages,' ii. 35.

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